```
# Install required libraries
!pip install transformers datasets matplotlib seaborn scikit-learn
!pip install --upgrade transformers huggingface_hub
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.48.3)
Collecting datasets
  Downloading datasets-3.3.2-py3-none-any.whl.metadata (19 kB)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.11/dist-packages (3.10.0)
Requirement already satisfied: seaborn in /usr/local/lib/python3.11/dist-packages (0.13.2)
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Requirement already satisfied: huggingface-hub<1.0,>=0.24.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.28.1)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (1.26.4)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2024.11.6)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from transformers) (2.32.3)
Requirement already satisfied: tokenizers<0.22,>=0.21 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.21.0)
Requirement already satisfied: safetensors>=0.4.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.5.3)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.11/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: pyarrow>=15.0.0 in /usr/local/lib/python3.11/dist-packages (from datasets) (18.1.0)
Collecting dill<0.3.9,>=0.3.0 (from datasets)
  Downloading dill-0.3.8-py3-none-any.whl.metadata (10 kB)
Requirement already satisfied: pandas in /usr/local/lib/python3.11/dist-packages (from datasets) (2.2.2)
Collecting xxhash (from datasets)
  Downloading xxhash-3.5.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (12 kB)
Collecting multiprocess<0.70.17 (from datasets)
  Downloading multiprocess-0.70.16-py311-none-any.whl.metadata (7.2 kB)
Requirement already satisfied: fsspec<=2024.12.0,>=2023.1.0 in /usr/local/lib/python3.11/dist-packages (from fsspec[http]<=2024.12.0,
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Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib) (1.3.1)
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Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (1.5.0)
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (6.1.0)
Requirement already satisfied: propcache>=0.2.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (0.3.0)
Requirement already satisfied: yarl<2.0,>=1.17.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (1.18.3)
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.11/dist-packages (from huggingface-hub<1.0,>=0.24
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas->datasets) (2025.1)
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Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.7->matplotlib) (1.17.0)
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Downloading dill-0.3.8-py3-none-any.whl (116 kB)
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Downloading multiprocess-0.70.16-py311-none-any.whl (143 kB)
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Downloading xxhash-3.5.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (194 kB)
   ──────────────────────────────────────── 194.8/194.8 kB 14.5 MB/s eta 0:00:00
Installing collected packages: xxhash, dill, multiprocess, datasets
Successfully installed datasets-3.3.2 dill-0.3.8 multiprocess-0.70.16 xxhash-3.5.0
Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.48.3)
Collecting transformers
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Requirement already satisfied: huggingface_hub in /usr/local/lib/python3.11/dist-packages (0.28.1)
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Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (1.26.4)
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Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (6.0.2)
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Requirement already satisfied: tokenizers<0.22,>=0.21 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.21.0)
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Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.11/dist-packages (from transformers) (4.67.1)
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Downloading transformers-4.49.0-py3-none-any.whl (10.0 MB)
```

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                                                                     10.0/10.0 MB 42.5 MB/s eta 0:00:00
    Downloading huggingface_hub-0.29.3-py3-none-any.whl (468 kB)
                                                                     469.0/469.0 kB 23.3 MB/s eta 0:00:00
    Installing collected packages: huggingface_hub, transformers
      Attempting uninstall: huggingface_hub
        Found existing installation: huggingface-hub 0.28.1
        Uninstalling huggingface-hub-0.28.1:
          Successfully uninstalled huggingface-hub-0.28.1
      Attempting uninstall: transformers
        Found existing installation: transformers 4.48.3
        Uninstalling transformers-4.48.3:
          Successfully uninstalled transformers-4.48.3
    Successfully installed huggingface_hub-0.29.3 transformers-4.49.0
    WARNING: The following packages were previously imported in this runtime:
      [huggingface_hub,transformers]
    You must restart the runtime in order to use newly installed versions.
```

```
  RESTART SESSION
```

```python
import json
from sklearn.model_selection import train_test_split
from google.colab import drive
import pandas as pd
drive.mount('/content/drive',force_remount=True)

# Load dataset
def load_dataset(file_path):
    data = []
    with open(file_path, 'r') as file:
        for line in file:
            data.append(json.loads(line))
    return data

# Paths to dataset files
train_file = "/content/drive/My Drive/2nd sem/CMPE252Paper/train.jsonl"
val_file = "/content/drive/My Drive/2nd sem/CMPE252Paper/val.jsonl"
test_file = "/content/drive/My Drive/2nd sem/CMPE252Paper/test.jsonl"

# Load datasets
train_data = load_dataset(train_file)
val_data = load_dataset(val_file)
test_data = load_dataset(test_file)

# Extract code and labels
def extract_features(data):
    codes = [entry['code'] for entry in data]
    labels = [entry['label'] for entry in data]
    return codes, labels

train_codes, train_labels = extract_features(train_data)
val_codes, val_labels = extract_features(val_data)
test_codes, test_labels = extract_features(test_data)
```

```
  ⇥  Mounted at /content/drive
```

```python
import numpy as np

# Calculate Code Bias Score (CBS)
def calculate_cbs(predictions, sensitive_attributes):
    bias_count = sum(1 for pred, attr in zip(predictions, sensitive_attributes) if pred == attr)
    return bias_count / len(predictions)

# Calculate Unfairness Score (UFS)
def calculate_ufs(predictions, sensitive_attributes):
    group_1 = [pred for pred, attr in zip(predictions, sensitive_attributes) if attr == 1]
    group_0 = [pred for pred, attr in zip(predictions, sensitive_attributes) if attr == 0]
    return abs(sum(group_1) / len(group_1) - sum(group_0) / len(group_0))

# Calculate Statistical Disparity (SD)
def calculate_sd(predictions, sensitive_attributes):
    group_counts = {}
    for pred, attr in zip(predictions, sensitive_attributes):
        group_counts[attr] = group_counts.get(attr, 0) + pred
    return max(group_counts.values()) - min(group_counts.values())
```

```python
from transformers import AutoTokenizer, AutoModelForSequenceClassification, Trainer, TrainingArguments
from datasets import Dataset

# Tokenize data
tokenizer = AutoTokenizer.from_pretrained("microsoft/codebert-base")

def tokenize_function(examples):
    return tokenizer(examples["code"], padding="max_length", truncation=True)

# Prepare datasets for training
train_dataset = Dataset.from_dict({"code": train_codes, "label": train_labels}).map(tokenize_function)
val_dataset = Dataset.from_dict({"code": val_codes, "label": val_labels}).map(tokenize_function)

# Load pre-trained model
model = AutoModelForSequenceClassification.from_pretrained("microsoft/codebert-base", num_labels=2)

# Define training arguments
training_args = TrainingArguments(
    output_dir="/content/drive/My Drive/2nd sem/CMPE252Paper/results",
    evaluation_strategy="epoch",
    save_strategy="steps",   # Save model every few steps
    save_steps=500,          # Save checkpoint every 500 steps
    learning_rate=2e-5,
    per_device_train_batch_size=8,
    per_device_eval_batch_size=8,
    num_train_epochs=1,
    logging_dir="./logs",
    logging_steps=100,
)


trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=train_dataset,
    eval_dataset=val_dataset,
)

# Train model
trainer.train()
```

```
/usr/local/lib/python3.11/dist-packages/huggingface_hub/utils/_auth.py:94: UserWarning:
The secret `HF_TOKEN` does not exist in your Colab secrets.
To authenticate with the Hugging Face Hub, create a token in your settings tab (https://huggingface.co/settings/tokens), set it as secre
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to access public models or datasets.
  warnings.warn(
Map: 100%                                      2744/2744 [00:01<00:00, 2674.19 examples/s]

Map: 100%                                      784/784 [00:00<00:00, 3244.47 examples/s]

Some weights of RobertaForSequenceClassification were not initialized from the model checkpoint at microsoft/codebert-base and are newly
You should probably TRAIN this model on a down-stream task to be able to use it for predictions and inference.
/usr/local/lib/python3.11/dist-packages/transformers/training_args.py:1594: FutureWarning: `evaluation_strategy` is deprecated and will
  warnings.warn(
wandb: WARNING The `run_name` is currently set to the same value as `TrainingArguments.output_dir`. If this was not intended, please spe
wandb: Using wandb-core as the SDK backend.  Please refer to https://wandb.me/wandb-core for more information.
```